

Recent progress with high resolution x-ray microscopy at the XM-1 microscope

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The XM-1 x-ray microscope is located at the Advanced Lights Source at Lawrence Berkeley National Laboratory. It is a full-field transmission x-ray microscope utilizing zone plates for both the condenser and objective lenses. It was designed to be a high-throughput tool for high-resolution x-ray microscopy. It continues to be a valuable scientific tool with a user-friendly design, and in recent years has been modified to probe a wider range of scientific samples. It has been shown to have a spatial resolution of 25 nanometers using high-precision optics fabricated with electron beam lithography. It has been used for magnetic imaging with contrast due to x-ray magnetic circular dichroism. This enables high-resolution, element-specific imaging of magnetic domains, even in applied magnetic fields. It has been used for cryo-tomography of biological samples with freezing and preservation of samples by helium gas. It has been used to study cement formation with high resolution imaging of the hydrated reaction. It has been used for studies of interconnects by exploiting the recently increased energy range that allows imaging at up to 1.8 keV for transmission through silicon.

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